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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b)

Attorney Docket No. 04198.P007 Total Pages 2

First Named Inventor or Application Identifier Nevo et al.

Express Mail Label No. EL034433371US

ADDRESS TO: **Assistant Commissioner for Patents**
Box Patent Application
Washington, D. C. 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
   (Submit an original, and a duplicate for fee processing)
2. X Specification (Total Pages 29)
   (preferred arrangement set forth below)
   - Descriptive Title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (if filed)
   - Detailed Description
   - Claims
   - Abstract of the Disclosure
3. X Drawings(s) (35 USC 113) (Total Sheets 9)
4. X Oath or Declaration (Total Pages 4) **unsigned**
   a. ___ Newly Executed (Original or Copy)
   b. ___ Copy from a Prior Application (37 CFR 1.63(d))
   (for Continuation/Divisional with Box 17 completed) **(Note Box 5 below)**
   i. ___ DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. __ Incorporation By Reference (useable if Box 4b is checked)
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. __ Microfiche Computer Program (Appendix)
7. __ Nucleotide and/or Amino Acid Sequence Submission
   (if applicable, all necessary)
   a. ___ Computer Readable Copy
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   c. ___ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. _____ Assignment Papers (cover sheet & documents(s))
9. _____ a. 37 CFR 3.73(b) Statement (where there is an assignee)
_____ b. Power of Attorney
10. _____ English Translation Document (if applicable)
11. _____ a. Information Disclosure Statement (IDS)/PTO-1449
_____ b. Copies of IDS Citations
12. _____ Preliminary Amendment
13. X Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. X a. Small Entity Statement(s) **(unsigned)**
b. Statement filed in prior application, Status still proper and desired
15. _____ Certified Copy of Priority Document(s) (if foreign priority is claimed)

16. X Other: Separate Sheet: Certificate of Mailing with Attorney Signature and copy of return postcard.

17. **If a CONTINUING APPLICATION,** check appropriate box and supply the requisite information:

___ Continuation ____ Divisional ____ Continuation-in-part (CIP)

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WIRELESS APPARATUS INTERFERENCE AVOIDANCE/RESOLUTION METHODS AND APPARATUSES
Inventors: Nevo et al.
Our Reference: 04198.P007

Respectfully submitted,

BLAKELY SOKOLOFF TAYLOR & ZAFMAN, L.L.P.

Date: 11/12, 1999

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Serial/Patent No.: not yet assigned Filing/Issue Date: November 12, 1999
Client: MOBILIAN (Nevo et al.)
Title: Wireless Apparatus Interference Avoidance/Resolution Methods and Apparatuses
BSTZ File No.: 04198.P007 Atty/Secty Initials: ATA/mjt
Date Mailed: 11/12/99 Docket Due Date: ****

The following has been received in the U.S. Patent & Trademark Office on the date stamped hereon:

- ☐ Amendment/Response (____ pgs.)
- ☐ Appeal Brief (____ pgs.) (in triplicate)
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- ☐ Application - Rule 1.53(b) Continuation (____ pgs.)
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- ☐ Application - Rule 1.53(b) CIP (____ pgs.)
- ☐ Application - Rule 1.53(d) CPA Transmittal (____ pgs.)
- ☐ Application - Design (____ pgs.)
- ☐ Application - PCT (____ pgs.)
- ☐ Application - Provisional (____ pgs.)
- ☐ Assignment and Cover Sheet
- ☒ Certificate of Mailing
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- ☐ Disclosure Docs & Orig & Copy of Inventor's Signed Letter (____ pgs)
- ☒ Drawings: 9 # of sheets includes 13 figures
- ☒ Express Mail No. EL034433371US ☒ Check No. 7055
- ☐ ____ Month(s) Extension of Time Amt: $470.00
- ☐ Information Disclosure Statement & PTO-1449 (____ pgs.) ☐ Check No. ____
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- ☐ Power of Attorney (____ pgs.)
- ☐ Preliminary Amendment (____ pgs.)
- ☐ Reply Brief (____ pgs.)
- ☐ Response to Notice of Missing Parts
- ☒ Small Entity Declaration for Indep. Inventor/Small Business (unsigned)
- ☒ Transmittal Letter, in duplicate
- ☒ Fee Transmittal, in duplicate

☒ Other: Separate page with attorney's signature and certificate of mailing (1 page in duplicate)

Applicant or Patentee: Ron Nevo et al. Attorney's Docket No.: 004198.P007
Serial or Patent No.: not yet assigned
Filed or Issued: November 12, 1999
For: WIRELESS APPARATUS INTERFERENCE AVOIDANCE/RESOLUTION METHOD AND APPARATUSES

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
37 CFR 1.9 (f) and 1.27(c) - - SMALL BUSINESS CONCERN

I hereby declare that I am:

[____] the owner of the small business concern identified below:
[XX] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: Mobilian, Inc.
ADDRESS OF CONCERN: 15455 N.W. Greenbrier Pkwy., Ste. 210
Beaverton, OR 97006

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby certify that to the best of my knowledge and belief rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention entitled WIRELESS APPARATUS INTERFERENCE AVOIDANCE/RESOLUTION METHODS AND APPARATUSES
by inventor(s) Ron Nevo, Ephraim Zehavi and Brett A. Monello
described in

[XX] the specification being filed herewith
[____] application serial no. _____, filed _____
[____] patent no. _____, issued _____

and I have reviewed the document that evidences the conveyance of those rights. That document

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may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Ephraim Zehavi
TITLE OF PERSON OTHER THAN OWNER: _____
ADDRESS OF PERSON SIGNING: 15455 N.W. Greenbrier Pkwy., Ste. 210, Beaverton, OR 97006
SIGNATURE: _____ DATE: _____

Our Ref.: 004198.P007

APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

Wireless Apparatus Interference Avoidance/Resolution Methods And Apparatuses

Inventor(s): **Ron Nevo**
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"Express Mail" label number EL034433371US

Date of Deposit November 12, 1999

Wireless Apparatus Interference Avoidance/Resolution Methods And Apparatuses

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of wireless communication. More specifically, the present invention relates to the problem of concurrent wireless communication with multiple communication partners of different wireless communication protocols.

2. Background Information

Advances in microprocessor and communication technology have led to the increase in popularity of wireless communication. Once confined to the privileged, wireless voice communication have become affordable and available to the masses. Today, various efforts are under way to apply wireless communication to replace attachment cables used for attaching peripheral devices, such as printers, scanners and the like, as well as networking cables used for connecting clients, servers and the like. A leading candidate to accomplish the former is commonly known to those skilled in the art as the Bluetooth technology or Bluetooth protocol. Examples of technology to accomplish the later include the different variants of the IEEE 802.11 Standard published by the Institute of Electrical and Electronic Engineers, 802.11 (Frequency Hopping, Direct Sequence), 802.11a, 802.11b, as well as Home RF, also known as Shared Wireless Access Protocol (SWAP) to those skilled in the art.

It is desirable for various applications to have wireless devices that operate in accordance with different protocols, and overlapping frequencies, to operate

proximately located to each other. Most wireless protocols employ carrier sense collision detection, and random back off to resolve collision or interference. However, experience has shown that prior art collision detection and back off approaches could substantially degrade the performance of both networks operating with overlapping frequencies. Accordingly, an improved approach to allow wireless devices operating with different protocols and overlapping frequencies to operate proximately close to each other is needed.

SUMMARY OF THE INVENTION

A wireless device is provided with a wireless transceiver to transmit and receive signals in accordance with a first protocol to and from network devices of a first wireless network, and a controller manager to control operation of the wireless transceiver. The wireless device is further provided with a wireless receiver to receive signals transmitted in accordance with a second protocol by network devices of a second wireless network, and the controller manager is equipped to control operation of the wireless transceiver based at least in part on at least one signaling characteristic of the received signals from network devices of the second wireless network, to reduce interference with proximately located ones of the network devices of the second wireless network.

In various embodiments, the controller manager suspends operation of the wireless transceiver whenever interference is predicted. In other embodiments, the controller manager causes an appropriate filter to be applied whenever interference is predicted.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

Figure 1 *illustrates an overview of an overlapping wireless network environment incorporated with the teaching of the present invention;*

Figures 2a-2c *illustrate a period of operation of the wireless devices of* ***Fig. 1****, in accordance with each of three embodiments;*

Figures 3a-3b *illustrate an architectural view and operation flow of "fully" enhanced wireless devices* ***104b*** *of* ***Fig. 1*** *in further detail, in accordance with one implementation;*

Figures 4a-4b *illustrate an architectural view and operation flow of "fully" enhanced wireless devices* ***104a*** *of* ***Fig. 1*** *in further detail, in accordance with one implementation;*

Figures 5a-5b *illustrate an architectural view and operation flow of "fully" enhanced wireless devices* ***104b*** *of* ***Fig. 1*** *in further detail, in accordance with another implementation;*

Figures 6a-6b *illustrate an architectural view and operation flow of "fully" enhanced wireless devices* ***104a*** *of* ***Fig. 1*** *in further detail, in accordance with another implementation; and*

Figure 7 *illustrates the concept of a notch filter.*

DETAILED DESCRIPTION OF THE INVENTION

In the following description, various aspects of the present invention will be described. However, it will be apparent to those skilled in the art that the present invention may be practiced with only some or all aspects of the present invention. For purposes of explanation, specific numbers, materials and configurations are set forth in order to provide a thorough understanding of the present invention. However, it will also be apparent to one skilled in the art that the present invention may be practiced without the specific details. In other instances, well known features are omitted or simplified in order not to obscure the present invention.

Parts of the description will be presented using software terminology commonly employed by those skilled in the art to convey the substance of their work to others skilled in the art. As well understood by those skilled in the art, these software quantities take the form of electrical, magnetic, or optical signals capable of being stored, transferred, combined, and otherwise manipulated through mechanical and electrical components of a digital system; and the term digital system includes general purpose as well as special purpose processors, systems, and the like, that are standalone, adjunct or embedded.

Various operations will be described as multiple discrete steps performed in turn in a manner that is most helpful in understanding the present invention, however, the order of description should not be construed as to imply that these operations are necessarily order dependent, in particular, the order the steps are presented. Furthermore, the phrase "in one embodiment" will be used repeatedly, however the phrase does not necessarily refer to the same embodiment, although it may.

*Referring now to **Figure 1**, wherein an overview of an overlapping network environment incorporated with the teachings of the present invention is shown. As illustrated, overlapping wireless network environment **100** includes wireless network devices **104a** of first wireless network **108a** operating in accordance with a first wireless protocol, and wireless network devices **104b** of second wireless network **108b** operating in accordance with a second wireless protocol. Wireless devices **104a** and **104b** are proximately located to each other, with at least some of wireless devices **104a** and **104b** being sufficiently close, such that when they transmit on the same frequency, they interfere (or "collide") with each other. In accordance with the present invention, one or more wireless devices **104a** and **104b** are incorporated with the teachings of the present invention, to facilitate pro-active interference avoidance or resolution. As a result, the amount of collision and the number of times wireless devices **104a** and **104b** have to go through the costly prior art back off, retry approaches are reduced, leading to overall improvement in efficiency for both wireless networks **108a-108b**.*

*In one embodiment, all devices **104a** are incorporated with the teachings of the present invention to predict when an interference will occur, and either pro-actively avoid or resolve the interference (hereinafter, "fully enhanced" devices). In another embodiment, only some of devices **104a** are so enhanced (one or more). In yet another embodiment, while only some of devices **104a** are so enhanced (one or more), other devices **104a** not so "enhanced" are nevertheless "minimally enhanced" to request the "fully enhanced" devices **104a** to at least preemptively notify them on when an interference is predicted to occur (hereinafter, "minimally enhanced" devices). The "fully enhanced" devices **104a** are further equipped to provide the preemptive notifications.*

*Likewise, in one embodiment, all devices **104b** are incorporated with the teachings of the present invention to predict when an interference will occur, and either pro-actively avoid or resolve interference (hereinafter, "fully enhanced" devices). In another embodiment, only some of devices **104b** are so enhanced. In yet another embodiment, while only some of devices **104b** are so enhanced, other devices **104b** not so enhanced are nevertheless "minimally" enhanced to request the "fully enhanced" devices **104b** to at least preemptively notify them on when interference is predicted to occur (hereinafter, "minimally enhanced" devices). The "fully enhanced" devices **104b** are further equipped to provide the preemptive notifications.*

*Referring now to **Figures 2a-2c**, wherein a period of operation for the wireless devices of **Fig. 1** in accordance with each of three alternate embodiments are shown. In each of these three alternate embodiments, first protocol of wireless devices **104a** of wireless network **108a** is assumed to be a frequency hopping protocol having a number of frequencies as shown, i.e. wireless devices **104a** hop from frequency to frequency in accordance with a pseudo random pattern to transmit signals. For ease of understanding, second protocol of wireless devices **104b** of network **108b** is assumed to be a constant frequency protocol (although in alternate embodiments, it may also be a frequency hopping protocol). In any event, to illustrate the present invention, at least one of the frequencies of the first protocol is the same frequency of the second protocol. Thus, if some of devices **104a** and **104b** are located sufficiently close to each other, and when one of devices **104a** selects the same frequency for transmission, interference (or collision) between these devices will occur, resulting in one or more transmission failures. For the illustrated example, frequency interference (or collision) is shown to occur at the 7th*

*and 14th hop (f_7 and f_{14}). That is, in accordance with the pseudo random pattern, in each of these two hops, devices **104a** transmit in the same frequency employed by devices **104b**. An example of a frequency hopping protocol is the Bluetooth protocol, and an example of a protocol having an interfering frequency with Bluetooth is the 802.11 protocol. [Note that the example interference at the 7th and 14th hop is not intended to suggest that the interference occurs at every 7th hop. The interference pattern is dictated by the intersection of the pseudo random pattern followed by the frequency hopping devices **104a** and the frequency employed by devices **104b**.]*

*In one embodiment, at least some of wireless devices **104a** and/or wireless devices **104b** are enhanced to proactively avoid interference (either "fully", or "minimally" as described earlier). The enhanced wireless devices **104a/104b** voluntarily let the other devices **104b/104a** be the "dominant" devices. That is, they voluntarily behave as the dominated devices. As the dominated devices, they voluntarily suspend operation (for a brief moment), whenever interference is predicted to occur, to pro-actively avoid interference with the dominant devices. As a result, the dominant devices may operate without being interfered with.*

*In another embodiment, at least some of wireless devices **104a** and/or wireless devices **104b** are enhanced to pro-actively resolve interference (either "fully" or "minimally" as described earlier). The enhanced wireless devices **104a/104b** apply appropriate corresponding filters, whenever interference is predicted to occur, to remove the corresponding interfering signals. As a result, interference is proactively resolved.*

Thus, in either of these embodiments, the time consuming collision detection, back off and retries (to resolve interference) are substantially reduced. Experience

has shown that the overall operating efficiencies of both networks improve, even in the case where one is a dominant network and the other is a dominated network.

***Fig. 2a** illustrates a period of operation where only wireless devices **104b** (all or selected ones) are enhanced to be the voluntary dominated devices ("fully" or "minimally", as described earlier), allowing wireless devices **104a**, the frequency hopping devices, to be the dominant devices. **Fig. 2b** illustrates a period of operation where only wireless devices **104a** (all or selected ones) are enhanced to be the voluntary dominated devices ("fully" or "minimally", as described earlier), allowing wireless devices **104b** to be the dominant devices. **Fig. 2c** illustrates a period of operation where wireless devices **104a** and/or **104b** (all or selected ones) are enhanced to apply appropriate corresponding filters ("fully" or "minimally", as described earlier), whenever interference is predicted to occur, to remove the corresponding interfering signals. Thus, as illustrated, under **Fig. 2a**, enhanced ones of wireless devices **104b** will voluntarily suspend operation (for a brief moment) at example interference hops f_7, f_{14} and so forth, to pro-actively avoid interference. Whereas under **Fig. 2b**, enhanced ones of wireless devices **104a** will voluntarily suspend operation (for a brief moment), at example interference hops f_7, f_{14} and so forth, to pro-actively avoid interference. Under **Fig. 2c**, enhanced ones of wireless devices **104a/104b** will apply the appropriate corresponding filters (for a brief moment) at example interference hops f_7, f_{14} and so forth, to pro-actively resolve interference.*

***Figures 3a-3b** illustrate the architecture and operational flow of an enhanced wireless device **104b** of **Fig. 1** for practicing the method of operation of **Fig. 2b**, in accordance with one embodiment (a "fully enhanced" embodiment). As described earlier, under the embodiment of **Fig. 2b**, wireless devices **104b** are enhanced to be*

*the voluntary dominated devices, allowing wireless devices **104a** to be the dominant devices, to proactively avoid interference. Enhanced wireless devices **104b** are to predict when an interference will occur, and at each of such predicted occurrence, voluntarily suspend operation (for a brief moment) to proactively refrain from interfering with wireless devices **104a**.*

*As illustrated in **Fig. 3a**, to enable wireless devices **104b** to so operate, each wireless device **104b**, in addition to conventional transceiver **1008** and controller manager **1006**, is additionally provided with state machine **1004**, receiver **1007** and interference avoidance manager **1005**. The elements are coupled to each other as shown.*

*Receiver **1007** is used to additionally receive signals transmitted in accordance with the first protocol between wireless devices **104a**, thus allowing the enhanced wireless device **104b**, to be able to receive signals in the first protocol, in addition to transmitting and receiving signals in the second protocol. Interference avoidance manager **1005** is equipped to determine at least a signaling characteristic of the first protocol, and predicts when an interference will occur, based on the determined one or more signal characteristics. For the illustrated embodiment, interference avoidance manager **1005** determines the pseudo random frequency hopping pattern followed by devices **104a**, and predicts when an interference will occur based on the determined pseudo random frequency hopping pattern. The determination may be made in any one of a number of techniques known in the art.*

*State machine **1004** is used to periodically generate a TX/RX or NOP control signal for controller manager **1006** to control transceiver **1008** accordingly, i.e. to transmit/receive or suspend operation (to pro-actively avoid interference). State machine **1004** generates the TX/RX or NOP control signal based on whether an interference is predicted by interference avoidance manager **1005**.*

*As illustrated in **Fig. 3b**, state machine **1004**, in addition to idle state **1010**, has two operating states (S1-S2) **1012-1014**. In state S1, state machine **1004** outputs the TX/RX control signal denoting performance of transmit/receive operation, and in state S2, state machine **1004** outputs the NOP control signal denoting suspension of transmit/receive operation.*

*Upon power-on or reset, state machine **1004** transitions from idle state **1010** to S1 state **1012**. While in S1 state **1012**, state machine **1004** remains in the state as long as an interference is not predicted by interference avoidance manager **1005**, outputting the TX/RX control signal for controller manager **1006**. Whenever an interference is predicted by interference avoidance manager **1005**, state machine **1004** transitions from S1 state **1012** to S2 state **1014**. While in S2 state **1014**, state machine **1004** remains in the state for a predetermined duration, outputting the NOP signal denoting suspension of transmit/receive operations for controller manager **1006**. The predetermined duration may be "hardwired", denoted through jumpers, or set through configuration registers, and the like. Upon expiration of the predetermined duration, state machine **1004** transitions from S2 state **1014** to S1 state **1012**. From S1 state **1012**, state machine **1004** continues operation as described earlier.*

*Except for the generation of the TX/RX and NOP control signals, and the control of transceiver **1008** by controller manager **1006** in accordance with these control signals, pro-actively avoiding interference with wireless device **104a**, each wireless device **104b**, including controller manager **1006** and transceiver **1008**, otherwise operates as known in the art.*

*Referring again to **Fig. 3a**, in one embodiment, in support of the "minimally enhanced" devices **104b**, interference avoidance manager **1005** further monitors*

*signals received by transceiver **1008** from other devices **104b**. In particular, interference avoidance manager **1005** monitors for requests from other "minimally enhanced" devices **104b** to be preemptively notified of a predicted occurrence of an interference. Upon receiving at least one such request, interference avoidance manager **1005** further causes each prediction to be broadcast for other devices **104b**, thereby allowing the "minimally enhanced" devices **104b** to be able to voluntarily behave as dominated devices (in favor of wireless devices **104a**, the dominant devices).*

*A "minimally enhanced" device **104b** may be constituted by slightly modifying controller manager **1006**, and additionally provided with only state machine **1007** (i.e., without providing receiver **1007** and interference manager **1005**). Controller manager **1006** is slightly modified to broadcast a request to the "fully enhanced" devices **104b**, to preemptively provide a prediction of interference, as described earlier. The broadcast e.g. may be made upon power on, reset, or periodically. State machine **1007** operates substantially as described earlier, i.e. outputting TX as long as no prediction of an interference occurrence is received, and outputting NOP for a predetermined duration whenever a prediction of an interference occurrence is received.*

***Figures 4a-4b** illustrate the architecture and operational flow of an enhanced wireless device **104a** of **Fig. 1** for practicing the method of operation of **Fig. 2a**, in accordance with one embodiment (a "fully enhanced" embodiment). As described earlier, under the embodiment of **Fig. 2a**, wireless devices **104a** are enhanced to be the voluntary dominated devices, allowing wireless devices **104b** to be the dominant devices, to proactively avoid interference. Enhanced wireless devices **104a** are to determine when a current frequency interferes with wireless device **104b**, and at*

*each of such determination (or "prediction", albeit with certainty), voluntarily suspend operation (for a brief moment) to proactively refrain from interfering with wireless devices **104b**.*

*As illustrated in **Fig. 4a**, to enable wireless devices **104a** to so operate, each wireless device **104a**, in addition to conventional transceiver **1108** and controller manager **1106**, is additionally provided with receiver **1107** and interference avoidance manager **1105**. The elements are coupled to each other as shown.*

*Receiver **1107** is used to additionally receive signals transmitted in accordance with the second protocol between wireless devices **104b**, thus allowing the enhanced wireless device **104a**, to be able to receive signals in the second protocol, in addition to transmitting and receiving signals in the first protocol. Interference avoidance manager **1105** is equipped to determine at least a signaling characteristic of the second protocol, monitor controller manager **1106**, determine if an interference is to occur based on the determined one or more signal characteristics, and proactively avoid the interference. For the illustrated embodiment, interference avoidance manager **1105** determines the signaling frequency of the second protocol, monitors the pseudo random frequency hopping pattern of controller manager **1106**, and determines if a current frequency is the same as the signaling frequency of the second protocol.*

*As illustrated in **Fig. 4b**, interference avoidance manager **1105** checks for interference, as controller manager **1106** controls transceiver **1108**, hopping from frequency to frequency, **1112**. If the current frequency is not the interfering frequency, interference avoidance manager **1105** allows controller manager **1106** to operate transceiver **1108** as known in the art, **1114**; otherwise, it causes controller manager **1106** to suspend transmit/receive operation, **1116**, pro-actively avoiding interference.*

*Except for the inclusion of receiver **1107** and interference avoidance manager **1105**, each wireless device **104a**, including controller manager **1106** and transceiver **1108**, otherwise operates as known in the art.*

*Referring again to **Fig. 4a**, in one embodiment, in support of the "minimally enhanced" devices **104a**, interference avoidance manager **1105** further monitors signals received by transceiver **1108** from other devices **104a**. In particular, interference avoidance manager **1105** monitors for requests from other "minimally enhanced" devices **104a** to be preemptively notified of a "predicted" occurrence of an interference. Upon receiving at least one such request, interference avoidance manager **1105** further causes each prediction to be broadcast for other devices **104a**, thereby allowing the "minimally enhanced" devices **104a** to be able to voluntarily behave as dominated devices (in favor of wireless devices **104b**, the dominant devices).*

*A "minimally enhanced" device **104a** may be constituted by slightly modifying controller manager **1106** (i.e., without providing receiver **1107** and interference manager **1105**). Controller manager **1106** is slightly modified to broadcast a request to "fully enhanced" devices **104a**, to preemptively provide a prediction of interference, as described earlier. The broadcast may be made e.g. at power on, reset or periodically. Otherwise, controller manager **1107** operates substantially as described earlier, i.e. operating transceiver **1108** to transmit and receive signals as long as no prediction of an interference occurrence is received, and suspending operation of transceiver **1108** for a predetermined duration whenever a prediction of an interference occurrence is received.*

Figures 5a-5b *illustrate the architecture and operational flow of an enhanced wireless device* ***104b*** *of* ***Fig. 1*** *for practicing the method of operation of* ***Fig. 2c****, in accordance with another embodiment (another "fully enhanced" embodiment). As described earlier, under the embodiment of* ***Fig. 2c****, wireless devices* ***104b*** *are enhanced to proactively resolve interference. Enhanced wireless devices* ***104b*** *are to predict when an interference will occur, and at each of such predicted occurrence, apply an appropriate filter (for a brief moment) to remove interfering signals of wireless devices* ***104a****.*

As illustrated in ***Fig. 5a****, to enable wireless devices* ***104b*** *to so operate, each wireless device* ***104b****, in addition to conventional transceiver* ***1208*** *and controller manager* ***1206****, is additionally provided with receiver* ***1207*** *and interference resolution manager* ***1205****. The elements are coupled to each other as shown.*

Receiver ***1207*** *is used to additionally receive signals transmitted in accordance with the first protocol between wireless devices* ***104a****, thus allowing the enhanced wireless devices* ***104b****, to be able to receive signals in the first protocol, in addition to transmitting and receiving signals in the second protocol. Interference resolution manager* ***1205*** *is equipped to determine at least a signaling characteristic of the first protocol, and predicts when an interference will occur, based on the determined one or more signal characteristics. For the illustrated embodiment, interference resolution manager* ***1205*** *determines the pseudo random frequency hopping pattern followed by devices* ***104a****, and predicts when an interference will occur based on the determined pseudo random frequency hopping pattern. The determination may be made in any one of a number of techniques known in the art. Additionally, interference resolution manager* ***1205*** *further determines an appropriate filter to be applied to remove the interfering signals of wireless devices* ***104a*** *at each predicted occurrence of interference. In one embodiment, the*

*appropriate filter is a notch filter, inversely formed based on the interfering signal (as illustrated in **Fig. 7**).*

*Thus, as illustrated in **Fig. 5b**, upon power on or reset, interference resolution manager **1205** monitors the transmit signals of devices **104a** to determine the pseudo random frequency hopping pattern followed by devices **104a**, and the appropriate filter to apply, **1210**. Thereafter, interference resolution manager **1205** determines if an interference is to occur, based on the determined pseudo random frequency hopping pattern, **1212**. Whenever an interference is predicted to occur, interference resolution manager **1205** outputs the appropriate control signal and filtering information for controller manager **1206** to apply the appropriate filter to proactively remove the interfering signals of wireless devices **104a**, **1214**.*

*Except for the determination of the pseudo random frequency hopping pattern of wireless devices **104a**, the determination of the appropriate filter, predicting when an interference will occur, and causing controller manager **1206** to apply the determined appropriate filter, each enhanced wireless device **104b**, including controller manager **1206** and transceiver **1208**, otherwise operates as known in the art.*

*Referring again to **Fig. 5a**, in one embodiment, in support of the "minimally enhanced" devices **104b**, interference resolution manager **1205** further monitors signals received by transceiver **1208** from other devices **104b**. In particular, interference resolution manager **1005** monitors for requests from other "minimally enhanced" devices **104b** to be preemptively notified of a predicted occurrence of an interference. Upon receiving at least one such request, interference resolution manager **1205** further causes each prediction to be broadcast for other devices*

***104b**, including the appropriate filter to apply, thereby allowing the "minimally enhanced" devices **104b** to be able to also proactively resolve interference.*

*A "minimally enhanced" device **104b** likewise may also be constituted by merely slightly modifying controller manager **1206**. Controller manager **1206** is slightly modified to broadcast a request to "fully enhanced" devices **104b**, to preemptively provide a prediction of interference, as described earlier. Again, the broadcast may be made e.g. at power on, reset, or periodically. Controller manager **1206** further causes the appropriate filter to be applied to received signals, whenever a prediction of an interference occurrence is received.*

***Figures 6a-6b** illustrate the architecture and operational flow of an enhanced wireless device **104a** of **Fig. 1** for practicing the method of operation of **Fig. 2c**, in accordance with another embodiment (another "fully enhanced" embodiment). As described earlier, under the embodiment of **Fig. 2c**, wireless devices **104a** are enhanced to proactively resolve interference. Enhanced wireless devices **104a** are to predict when an interference will occur, and at each of such predicted occurrence, apply an appropriate filter (for a brief moment) to remove interfering signals of wireless devices **104b**.*

*As illustrated in **Fig. 6a**, to enable wireless devices **104a** to so operate, each wireless device **104a**, in addition to conventional transceiver **1308** and controller manager **1306**, is additionally provided with receiver **1307** and interference resolution manager **1305**. The elements are coupled to each other as shown.*

*Receiver **1307** is used to additionally receive signals transmitted in accordance with the second protocol between wireless devices **104b**, thus allowing the enhanced wireless device **104a**, to be able to receive signals in the second*

*protocol, in addition to transmitting and receiving signals in the first protocol. Interference resolution manager **1305** is equipped to determine at least a signaling characteristic of the second protocol, determine if an interference is to occur based on the determined one or more signal characteristics, and proactively avoid the interference. For the illustrated embodiment, interference avoidance manager **1105** determines the signaling frequency of the second protocol. Additionally, interference resolution manager **1305** further determines an appropriate filter to be applied to remove the interfering signals of wireless devices **104b** at each predicted occurrence of interference. In one embodiment, the appropriate filter is also a notch filter, inversely formed based on the interfering signal (as illustrated in **Fig. 7**).*

*Thus, as illustrated in **Fig. 6b**, upon power on or reset, interference resolution manager **1305** monitors the transmit signals of devices **104b** to determine the signaling frequency of devices **104b**, and the appropriate filter to apply, **1310**. Thereafter, interference resolution manager **1305** monitors the pseudo random frequency hopping pattern of controller manager **1306**, and determines if the current frequency is the same as the signaling frequency of devices **104b**, **1312**. If the current frequency is not the interfering frequency, interference resolution manager **1305** allows controller manager **1306** to operate transceiver **1308** as known in the art, otherwise, interference resolution manager **1305** outputs the appropriate control signal, including the filtering information, to cause controller manager **1306** to apply the appropriate filter to the received signals, to proactively resolve interference, **1314**.*

*Except for the inclusion of receiver **1307** and interference resolution manager **1305**, each wireless device **104a**, including controller manager **1106** and transceiver **1108**, otherwise operates as known in the art.*

*Referring again to **Fig. 6a**, in one embodiment, in support of "minimally enhanced" devices **104a**, interference resolution manager **1305** further monitors signals received by transceiver **1308** from other devices **104a**. In particular, interference resolution manager **1305** monitors for requests from other "minimally enhanced" devices **104a** to be preemptively notified of a "predicted" occurrence of an interference. Upon receiving at least one such request, interference resolution manager **1305** further causes each prediction to be broadcast for other devices **104a**, thereby allowing the "minimally enhanced" devices **104a** to also proactively resolve interference.*

*A "minimally enhanced" device **104a** may likewise be constituted by merely slightly modifying controller manager **1306** (i.e., without providing receiver **1307** and interference manager **1305**). Controller manager **1306** is slightly modified to broadcast a request to "fully enhanced" device **104a**, to preemptively provide a prediction of interference and associated filtering information, as described earlier. Otherwise, controller manager **1307** operates substantially as described earlier, i.e. operating transceiver **1308** to transmit and receive signals as long as no prediction of an interference occurrence is received, and proactively filters received signals whenever a prediction of an interference occurrence is received.*

Thus, wireless devices equipped to proactively avoid interference have been described. While the present invention has been described in terms of the above illustrated embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described. The present invention can be practiced with modification and alteration within the spirit and scope of the appended claims. *For example, in each of the "filtering" embodiments, the appropriate filtering may be "recursively" or "incrementally" determined. As a further example, each of enhanced*

*wireless devices **104a** and **104b** may be further enhanced to allow the pro-active interference avoidance/resolution function to be configurably enabled or disabled.* The description is thus to be regarded as illustrative instead of restrictive on the present invention.

5

CLAIMS

What is claimed is:

1. An apparatus comprising:

a wireless transceiver to transmit and receive signals in accordance with a first protocol to and from first other apparatuses of a first wireless network;

a wireless receiver to receive signals transmitted in accordance with a second protocol by second other apparatuses of a second wireless network; and

a controller manager coupled to the wireless transceiver and receiver to control operation of the wireless transceiver based at least in part on one signaling characteristic of said received signals from said second other apparatuses of the second wireless network, to reduce interference with said second other apparatuses of the second wireless network.

2. The apparatus of claim 1, wherein said second protocol is a frequency hopping protocol comprising a plurality of frequencies employed in accordance with a pseudo random pattern, and the controller manager includes logic to ascertain the pseudo random frequency hopping pattern using said received signals from said second other apparatuses.

3. The apparatus of claim 2, wherein the controller manager further includes logic to predict when interference with said second other apparatuses of said second wireless network will occur, based on said ascertained pseudo random frequency hopping pattern.

4. The apparatus of claim 1, wherein said second protocol is a constant frequency protocol, and the controller manager includes logic to ascertain the constant frequency using said received signals from said second other apparatuses.

5. The apparatus of claim 4, wherein the controller manager further includes logic to predict when interference with said second other apparatuses of said second wireless network will occur, based on said ascertained constant frequency.

6. The apparatus of claim 1, wherein the controller manager further includes logic to suspend operation of said wireless transceiver to avoid interference with said second other apparatuses of said second wireless network, whenever an interference is predicted to occur.

7. The apparatus of claim 1, wherein the controller manager further includes logic to determine filtering to be employed, whenever an interference is predicted to occur, to cancel interfering signals from said second other apparatuses.

8. The apparatus of claim 7, wherein the controller manager includes logic to determine a notch filter, inversely formed in accordance with transmit signals of said second other apparatuses.

9. The apparatus of claim 7, wherein the controller manager includes logic to employ said filtering to cancel interfering signals of said second other apparatuses of said second wireless network, whenever an interference is predicted to occur.

10. The apparatus of claim 1, wherein the controller manager further includes logic to preemptively notify one or more of said first other apparatuses, an interference is predicted to occur.

11. The apparatus of claim 10, wherein the controller manager further includes logic to preemptively notify said one or more of said first other apparatuses, a selected one of suspending operation to avoid interference with said second other apparatuses and applying filtering to cancel interfering signals from said second other apparatuses.

12. The apparatus of claim 1, wherein the controller manager further includes logic to request one of said first other apparatuses to preemptively provide notification of a predicted occurrence of an interference with said second other apparatuses.

13. The apparatus of claim 1, wherein the first protocol is a protocol selected from a group consisting of 802.11, 802.11a, 802.11b, and Home RF, and the second protocol is the Bluetooth protocol.

14. The apparatus of claim 1, wherein the first protocol is the Bluetooth protocol, and the second protocol is a protocol selected from a group consisting of 802.11, 802.11a, 802.11b, and Home RF.

15. In a wireless apparatus having a wireless transceiver and a wireless receiver; a method of operation comprising:

(a) receiving signals transmitted in accordance with a first protocol by first other apparatuses of a first wireless network;

(b) determining at least one signaling characteristic of said received signals from said first other apparatuses; and

(c) operating said wireless transceiver to transmit and receive signals in accordance with a second protocol to and from second other apparatuses of a second wireless network, based on said at least one determined signaling characteristic of said received signals from said first other apparatuses, to reduce interference with proximately located ones of said first other apparatuses of the first wireless network.

16. The method of claim 15, wherein said first protocol is a frequency hopping protocol comprising a plurality of frequencies employed in accordance with a pseudo random pattern, and the method further comprises ascertaining the pseudo random frequency hopping pattern using said received signals from said first other apparatuses.

17. The method of claim 16, wherein the method further comprises predicting when interference with said first other apparatuses of said first wireless network will occur, based on said ascertained pseudo random frequency hopping pattern.

18. The method of claim 15, wherein said first protocol is a constant frequency protocol, and the method further comprises ascertaining the constant frequency using said received signals from said first other apparatuses.

19. The method of claim 18, wherein the method further comprises predicting when interference with said first other apparatuses of said first wireless network will occur, based on said ascertained constant frequency.

20. The method of claim 15, wherein the method further comprises suspending operation of said wireless transceiver to avoid interference with said first other apparatuses of said first wireless network, whenever an interference is predicted to occur.

21. The method of claim 13, wherein the method further comprises determining filtering to be employed, whenever an interference is predicted to occur, to cancel interfering signals from said first other apparatuses.

22. The method of claim 21, wherein the method further comprises determining a notch filter, inversely formed in accordance with transmit signals of said first other apparatuses.

23. The method of claim 21, wherein the method further comprises employing said filtering to cancel interfering signals of said first other apparatuses of said first wireless network, whenever an interference is predicted to occur.

24. The method of claim 15, wherein the method further comprises preemptively notifying one or more of said second other apparatuses, an interference is predicted to occur.

25. The method of claim 24, wherein the method further comprises preemptively notifying said one or more of said second other apparatuses, a selected one of suspending operation to avoid interference with said first other apparatuses and applying filtering to cancel interfering signals from said first other apparatuses.

26. The method of claim 15, wherein the method further comprises requesting one of said second other apparatuses to preemptively provide notification of a predicted occurrence of an interference with said first other apparatuses.

27. A collection of apparatuses comprising:

a first plurality of apparatuses equipped to communicate wirelessly in accordance with a first protocol; and

a second plurality of apparatuses equipped to communicate wirelessly in accordance with a second protocol, wherein at least one of the second plurality of apparatuses is further equipped to receive signals transmitted in said first protocol, and determine at least one signaling characteristics of said received signals transmitted in accordance with said first protocol, and to reduce interference with proximately located one or ones of said first plurality of apparatuses based on said determined at least one signaling characteristics of said received signals transmitted in accordance with said first protocol.

28. The collection of apparatuses of claim 27, wherein the at least one of the second plurality of apparatuses includes logic to predict an interference with said first plurality of apparatuses is to occur.

29. The collection of apparatuses of claim 27, wherein the at least one of the second plurality of apparatuses includes logic to suspend transmit operation to avoid interference with said first plurality of apparatuses, whenever an interference with said first plurality of apparatuses is predicted to occur.

30. The collection of apparatuses of claim 27, wherein the at least one of the second plurality of apparatuses includes logic to applying filtering to cancel interfering signals of said first plurality of apparatuses, whenever an interference with said first plurality of apparatuses is predicted to occur.

ABSTRACT OF THE DISCLOSURE

A wireless device is provided with a wireless transceiver to transmit and receive signals in accordance with a first protocol to and from network devices of a first wireless network, and a controller manager to control operation of the wireless transceiver. The wireless device is further provided with a wireless receiver to receive signals transmitted in accordance with a second protocol by network devices of a second wireless network, and the controller manager is equipped to control operation of the wireless transceiver based at least in part on at least one signaling characteristic of the received signals from network devices of the second wireless network, to reduce interference with proximately located ones of the network devices of the second wireless network. In various embodiments, the controller manager suspends operation of the wireless transceiver whenever interference is predicted. In other embodiments, the controller manager causes an appropriate filter to be applied whenever interference is predicted.

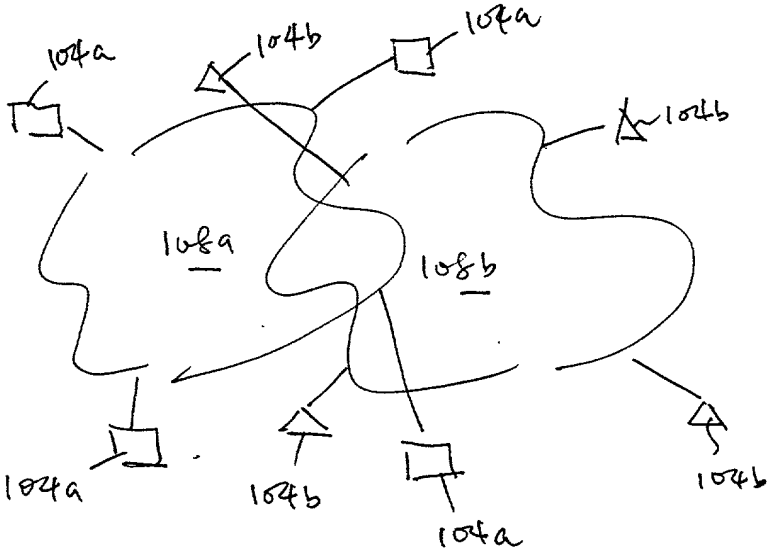

FIG. 1

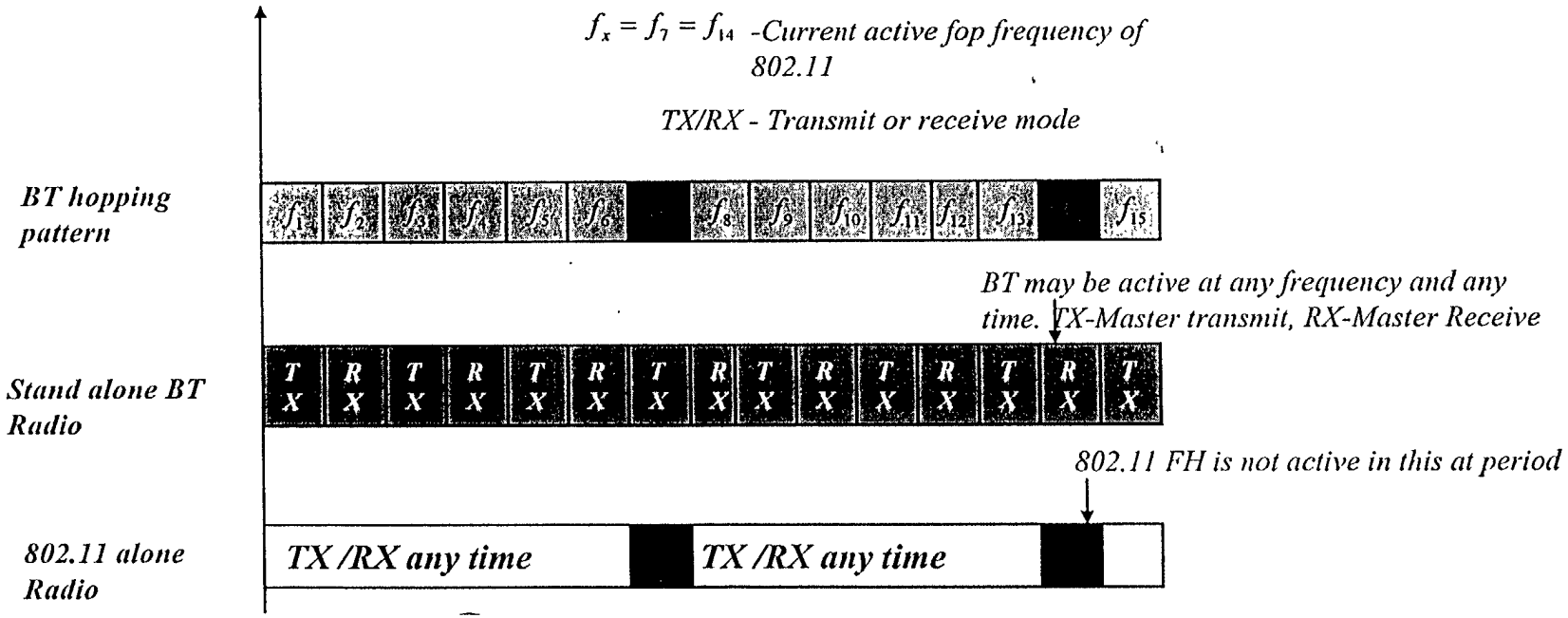
$f_x = f_7 = f_{14}$ -Current active fop frequency of 802.11
TX/RX - Transmit or receive mode
BT hopping pattern
f_1 f_2 f_3 f_4 f_5 f_6 f_8 f_9 f_{10} f_{11} f_{12} f_{13} f_{15}
BT may be active at any frequency and any time.
TX-Master transmit, RX-Master Receive
Stand alone BT Radio
T X R X T X R X T X R X T X R X T X R X T X R X T X R X T X
802.11 FH is not active in this at period
802.11 alone Radio
TX /RX any time
TX /RX any time

Fig. 2a

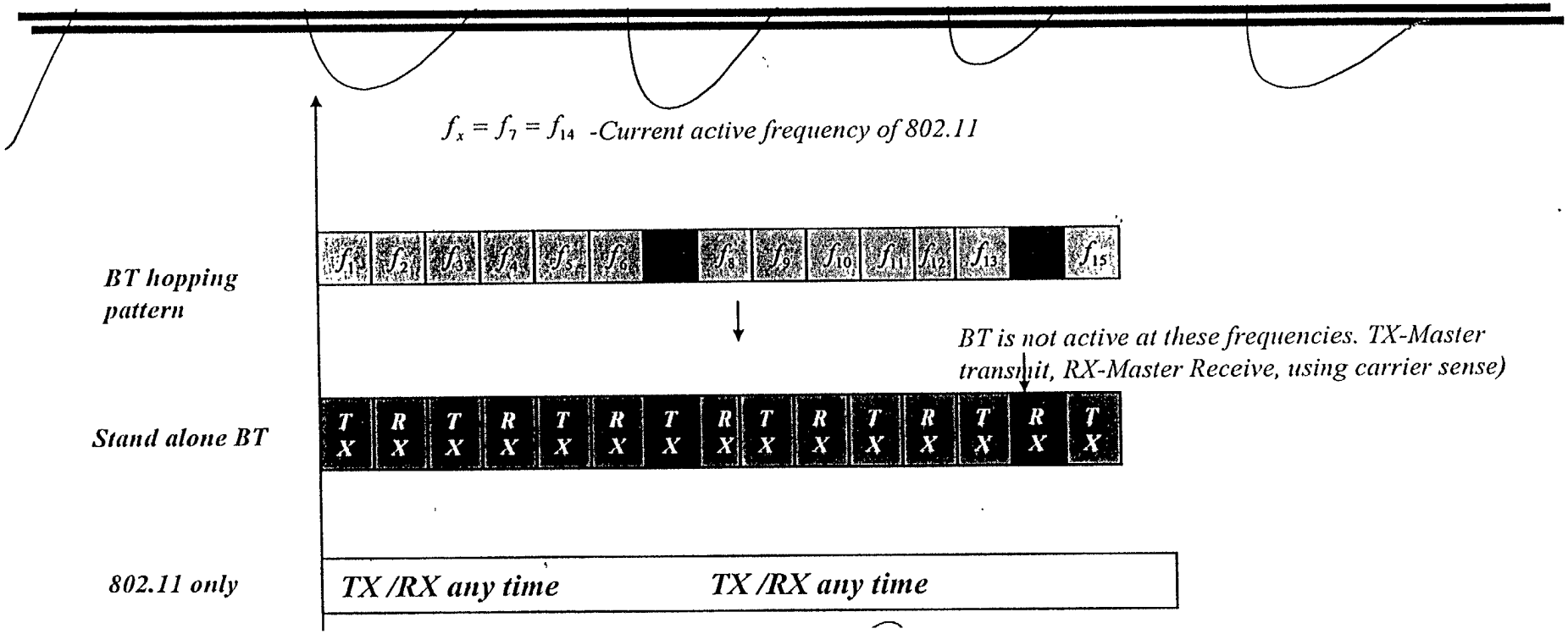

FIG. 2b

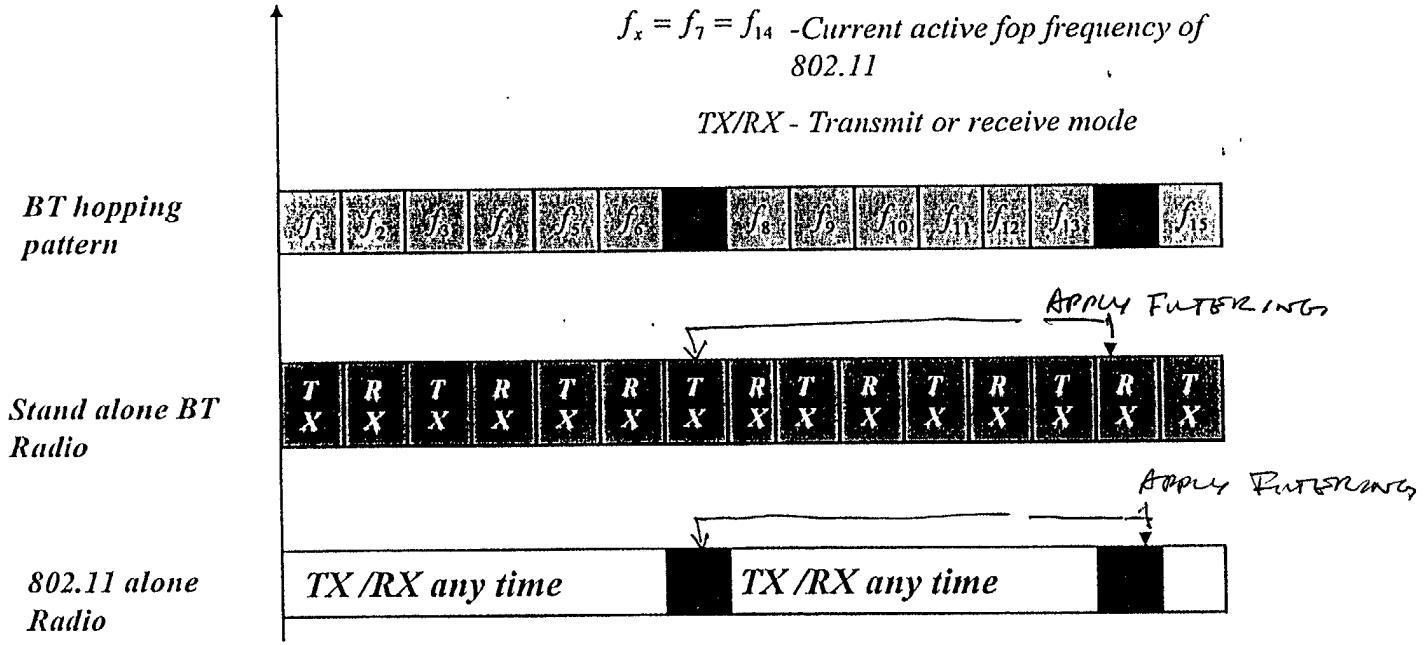

FIG. 2C

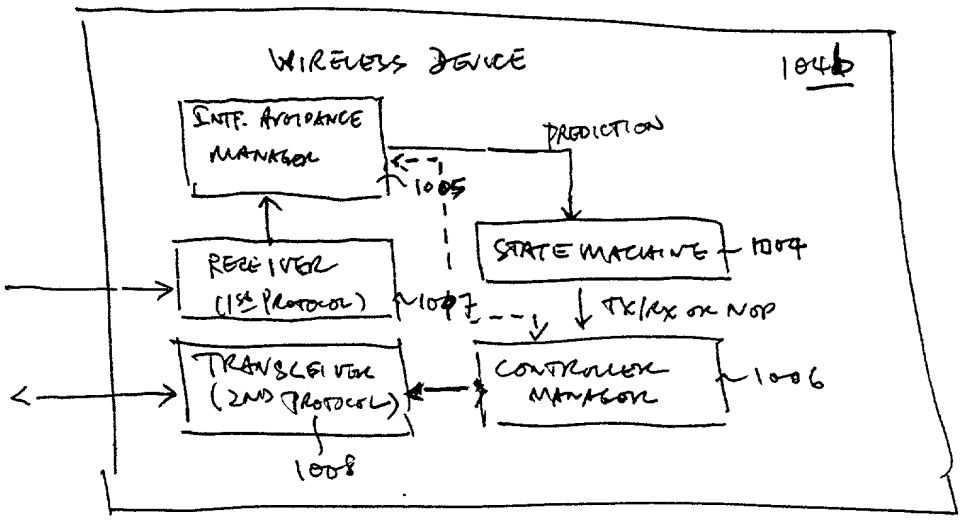
WIRELESS DEVICE
1004b
INTF. AVOIDANCE MANAGER
PREDICTION
1005
STATE MACHINE
1004
RECEIVER (1st PROTOCOL)
1007
TX/RX OR NOP
TRANSCEIVER (2ND PROTOCOL)
CONTROLLER MANAGER
1006
1008

FIG. 3a

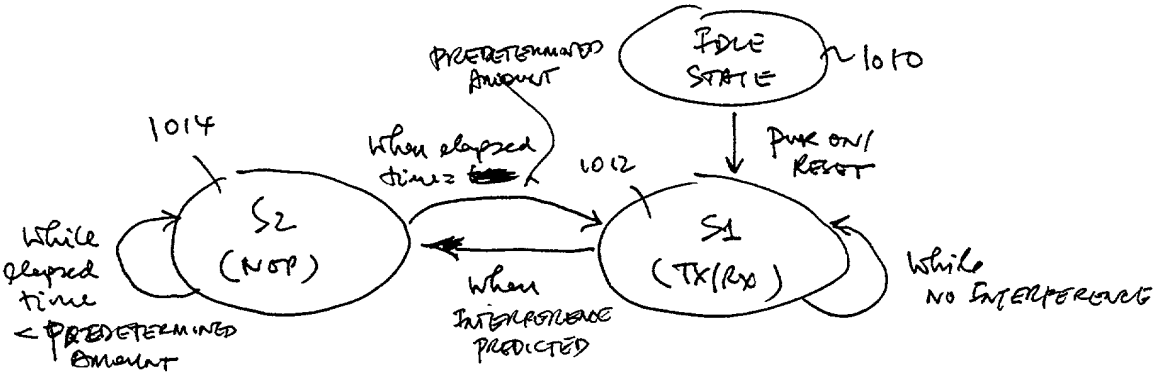
PREDETERMINED AMOUNT
IDLE STATE
1010
1014
When elapsed time =
1012
PWR ON/ RESET
S2 (NOP)
S1 (TX/RX)
While elapsed time < PREDETERMINED AMOUNT
When INTERFERENCE PREDICTED
While NO INTERFERENCE

FIG. 3b

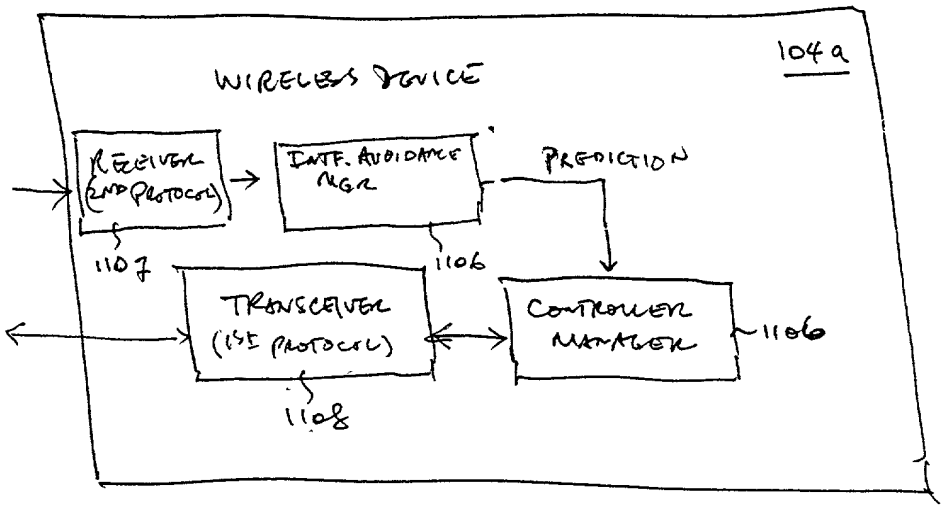
WIRELESS DEVICE
104a
RECEIVER (END PROTOCOL)
INTF. AVOIDANCE MGR
PREDICTION
1107
1106
TRANSCEIVER (ISE PROTOCOL)
CONTROLLER MANAGER
1106
1108

Fig. 4a

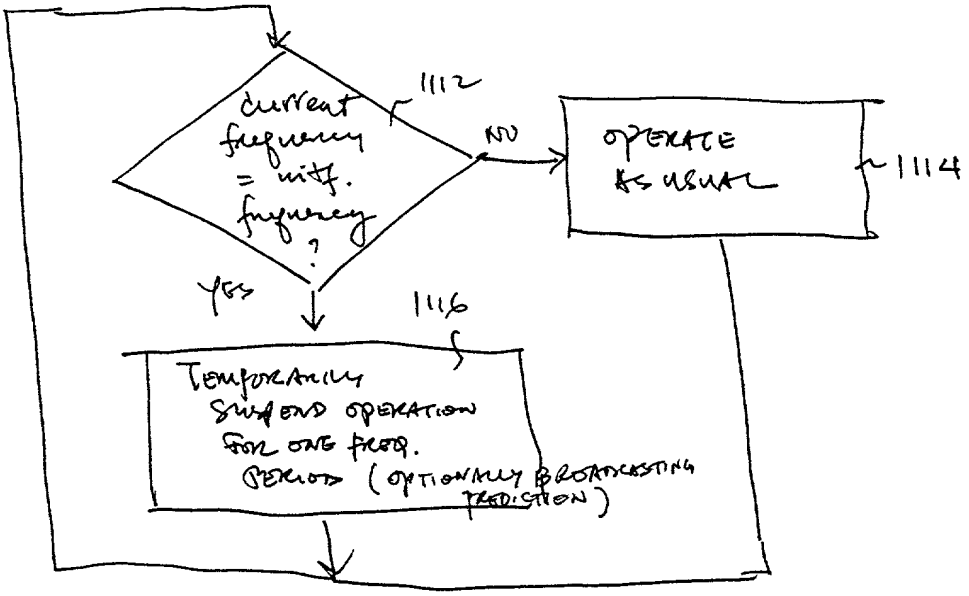
current frequency = intf. frequency ?
1112
NO
OPERATE AS USUAL
1114
YES
1116
TEMPORARILY SUSPEND OPERATION FOR ONE FREQ. PERIOD (OPTIONALLY BROADCASTING PREDICTION)

Fig. 4b

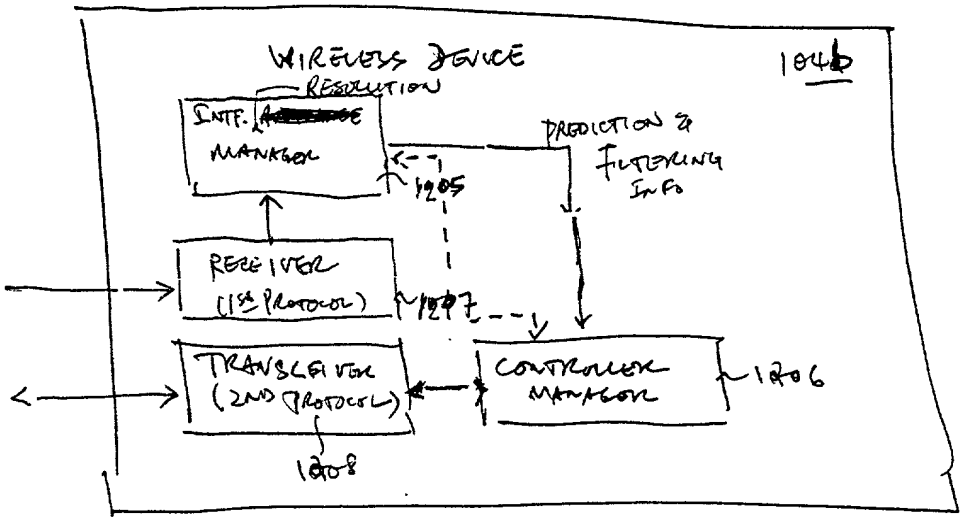
WIRELESS DEVICE
1040
RESOLUTION
INTF. MANAGER
1205
PREDICTION & FILTERING INFO
REGISTER (1ST PROTOCOL)
1207
TRANSCEIVER (2ND PROTOCOL)
CONTROLLER MANAGER
1206
1208

FIG. 5a

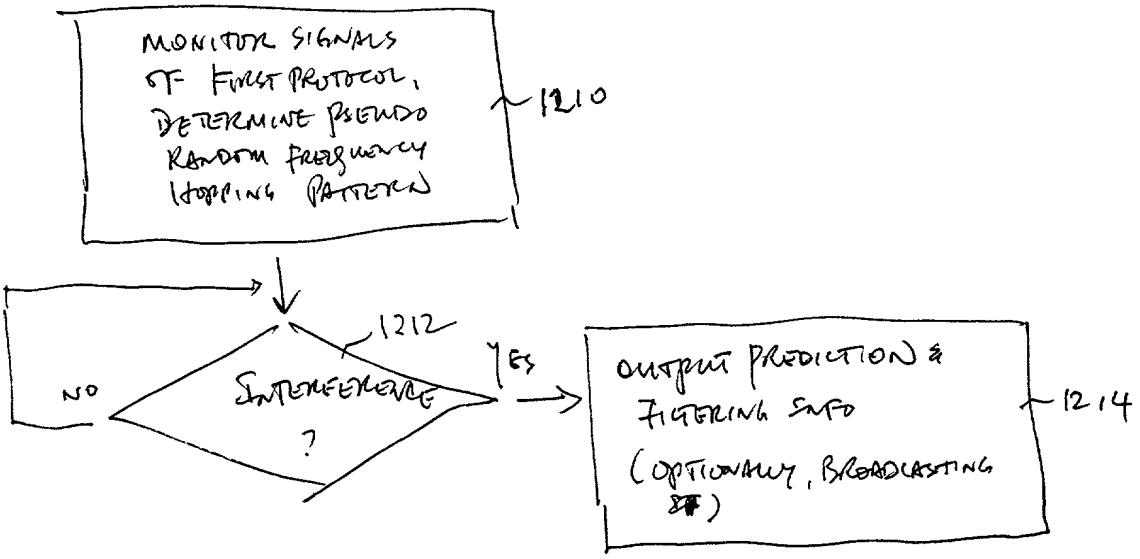
MONITOR SIGNALS OF FIRST PROTOCOL, DETERMINE PSEUDO RANDOM FREQUENCY HOPPING PATTERN
1210
1212
INTERFERENCE ?
NO
YES
OUTPUT PREDICTION & FILTERING INFO (OPTIONALLY, BROADCASTING IT)
1214

FIG. 5b

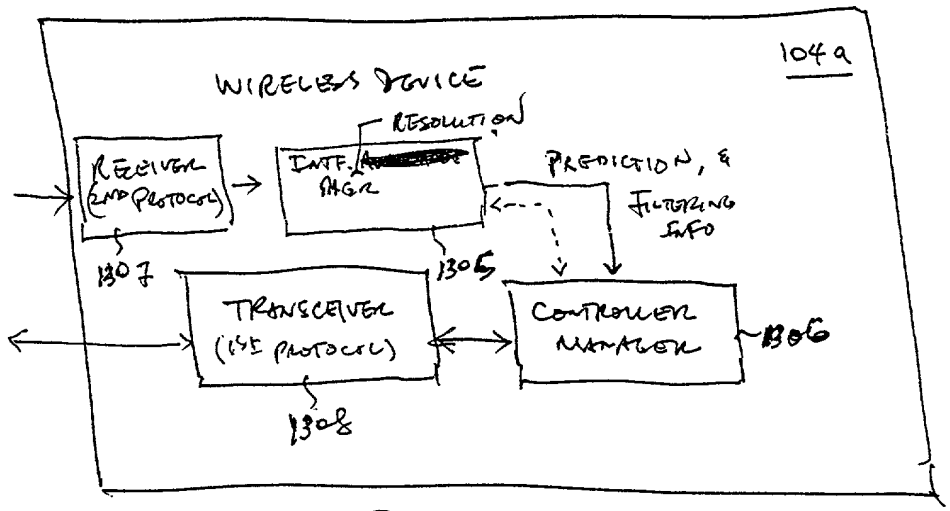
104a
WIRELESS DEVICE
RESOLUTION
RECEIVER (2ND PROTOCOL)
INTF. MGR
PREDICTION, & FILTERING INFO
1307
1305
TRANSCEIVER (1ST PROTOCOL)
CONTROLLER MANAGER
1306
1308

Fig. 6a

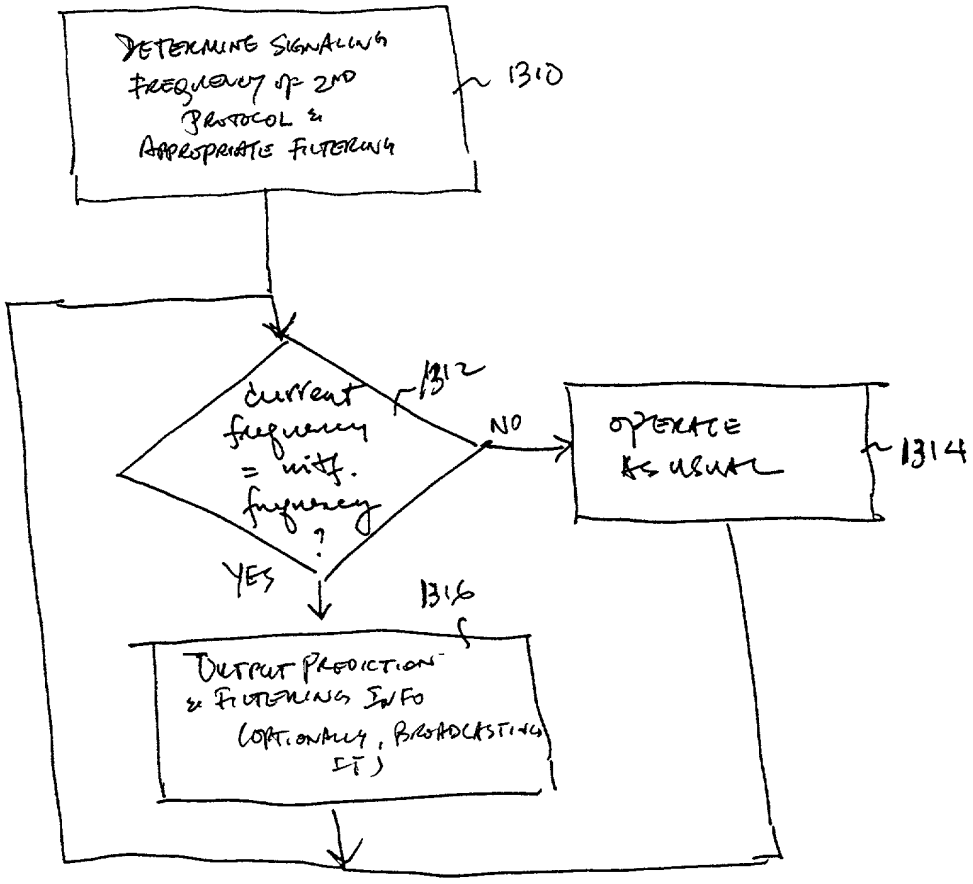
DETERMINE SIGNALING FREQUENCY OF 2ND PROTOCOL & APPROPRIATE FILTERING
1310
current frequency = init. frequency ?
1312
NO
OPERATE AS USUAL
1314
YES
1316
OUTPUT PREDICTION & FILTERING INFO (OPTIONALLY, BROADCASTING IT)

Fig. 6b

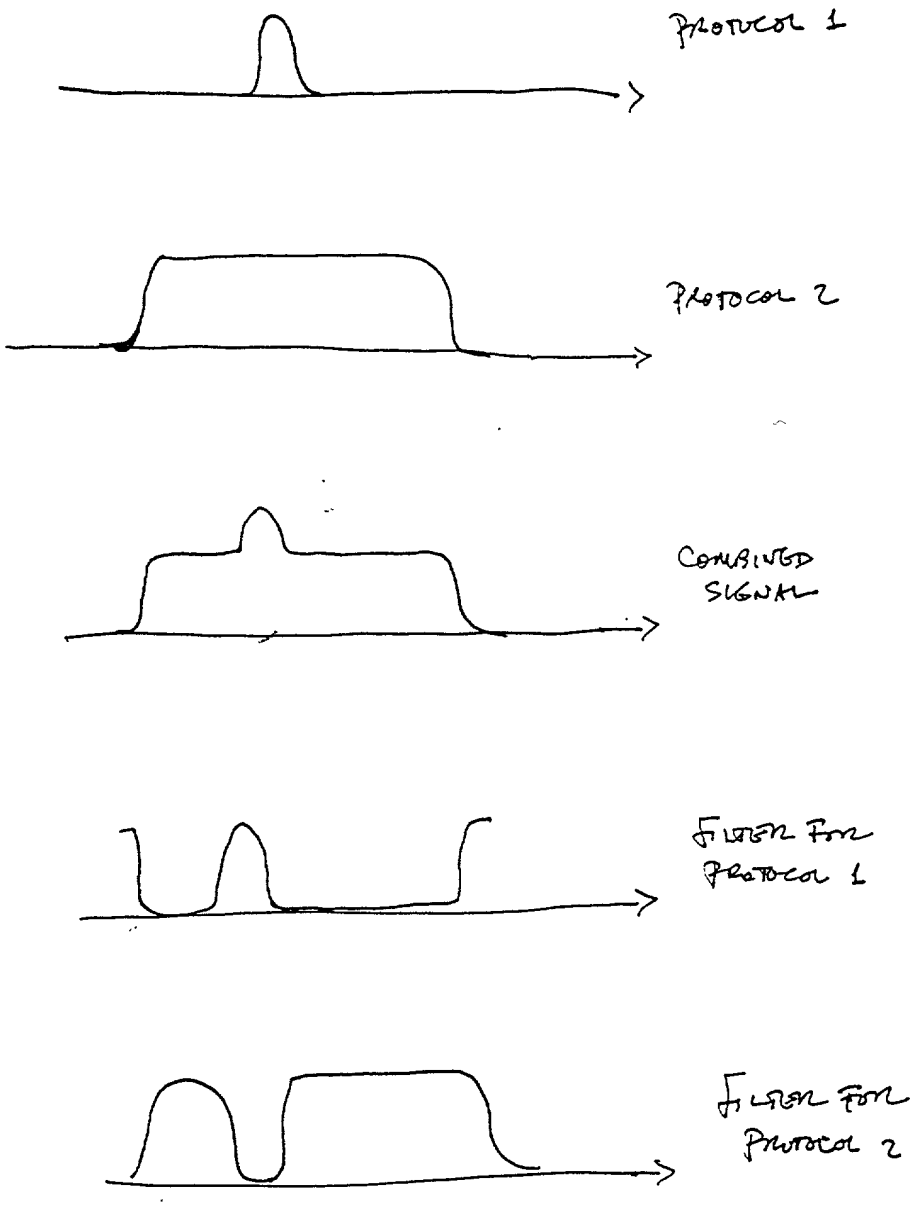
PROTOCOL 1
PROTOCOL 2
COMBINED SIGNAL
FILTER FOR PROTOCOL 1
FILTER FOR PROTOCOL 2

FIG 7

Attorney's Docket No.: 04198.P007 PATENT

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

WIRELESS APPARATUS INTERFERENCE AVOIDANCE/RESOLUTION METHODS AND APPARATUSES

the specification of which

XX is attached hereto.
___ was filed on _____ as
United States Application Number _____
or PCT International Application Number _____
and was amended on _____.
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below

(Application Number)	Filing Date

(Application Number) Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)
(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

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Send correspondence to Aloysius T.C. AuYeung (Name of Attorney or Agent), BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, 12400 Wilshire Boulevard 7th Floor, Los Angeles, California 90025 and direct telephone calls to Aloysius T.C. AuYeung (Name of Attorney or Agent), (503) 684-6200.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.